

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000035010_02

AMS designation: ENDA-5000 with analysing module CMA-5800 E
for CO, NO_x, SO₂, O₂ and CO₂

Manufacturer: Horiba GmbH
Kaplanstrasse 5
A-3430 Tulln
Austria

Test Laboratory: TÜV Rheinland Energy GmbH

**This is to certify that the AMS has been tested
and found to comply with the standards
EN 15267-1 (2009), EN 15267-2 (2009), EN 15267-3 (2007)
and EN 14181 (2014).**

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 14 pages).
The present certificate replaces certificate 0000035010_01 of 28 February 2017.



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000035010

Publication in the German Federal Gazette
(BAnz) of 02 March 2012

German Federal Environment Agency
Dessau, 16 February 2022

This certificate will expire on:
01 March 2027

TÜV Rheinland Energy GmbH
Cologne, 15 February 2022



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Test institute accredited to EN ISO/IEC 17025 by DAkkS (German Accreditation Body).
This accreditation is limited to the accreditation scope defined in the enclosure to certificate D-PL-11120-02-00.

Test report:	936/21212266/A of 18 October 2011
Initial certification:	16 March 2012
Expiry date:	01 March 2027
Certificate	Renewal (of previous certificate 0000035010_01 of 28 February 2017 valid until 01 March 2022)
Publication:	BAnz. 02 March 2012, no. 36, p. 920, chapter I number 4.5

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13th BImSchV), chapter IV (17th BImSchV), 30th BImSchV, plants in compliance with TA Luft, plants according to the 27th BImSchV and other plants requiring official approval. The measured ranges have been selected so as to ensure as broad a field of application as possible.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a 5-month field test at a waste incineration plant.

The AMS is approved for an ambient temperature range of +5° to +40°C.

The notification of suitability of the AMS, performance testing and the uncertainty calculation have been effected on the basis of the regulations applicable at the time of testing. As changes in legal provisions are possible, any potential user should ensure that this AMS is suitable for monitoring the limit values and oxygen concentrations relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the intended purpose.

Basis of the certification

This certification is based on:

- Test report 936/21212266/A of 18 October 2011 by TÜV Rheinland Energie und Umwelt GmbH
- Suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- The ongoing surveillance of the product and the manufacturing process

Publication in the German Federal Gazette: BAnz. 02 March 2012, no. 36, p. 920, chapter I number 4.5, UBA announcement dated 23 February 2012:

AMS designation:

ENDA-5000 with analysing module CMA-5800 for NO_x, SO₂, CO, CO₂ und O₂

Manufacturer:

HORIBA GmbH, Tulln, Austria

Field of application:

For plants requiring official approval and for plants according to the 27th BImSchV

Measuring ranges during performance testing:

Component	Certification range	Supplementary measuring ranges	Unit
NO _x	0 - 153 ¹⁾	0 - 1,530 ²⁾	mg/m ³
SO ₂	0 - 75	0 - 750	mg/m ³
CO	0 - 50	0 - 500	mg/m ³
CO ₂	0 - 20	0 - 25	Vol.-%
O ₂	0 - 25	0 - 10	Vol.-%

1) as NO₂, this corresponds to approx. 0 - 100 mg/m³ NO

2) as NO₂, this corresponds to approx. 0 - 1,000 mg/m³ NO

Software version:

P1000877001I

Restrictions:

None

Note:

The maintenance interval is four weeks with a container size for the phosphoric acid of 40 l.

Test Report:

TÜV Rheinland Energy GmbH, Cologne

Report no.: 936/21212266/A of 18 October 2011

Publication in the German Federal Gazette: BAnz AT 20.07.2012 B11, chapter IV
4th notification, UBA announcement dated 06 July 2012:

**4 Notification as regards Federal Environment Agency notice
of 23 February 2012 (BAnz. p. 920, chapter I number 4.5)**

The ENDA-5000 multi-component measuring system with CMA-5800 analyser manufactured by Horiba GmbH may either be supplied with the given, previously known type SP2000 gas sampling probe manufactured by M&C or with either of the probe types SP2200-H/C/I/BB or SP2200-H/I/BB-F from the same manufacturer.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH
dated 20 March 2012

Publication in the German Federal Gazette: BAnz AT 05.03.2013 B10, chapter V
28th notification, UBA announcement dated 12 February 2013:

**28 Notification as regards Federal Environment Agency (UBA) notices
of 23 February 2012 (BAnz. p. 920, chapter I number 4.5) and
of 06 July 2012 (BAnz AT 20.07.2012 B11, chapter IV, 4th notification)**

The ENDA-5000 measuring system with analyser module CMA-5800 for NO_x, SO₂, CO, CO₂ and O₂ manufactured by Horiba GmbH can also be operated with the gas sampling probe GAS 222.21 manufactured by SICOM Prozeß- und Umwelttechnik GmbH instead of with the already notified sampling probe. The former is identical in design to a probe manufactured by Bühler Technologies GmbH with the same designation.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH
dated 11 October 2012

Publication in the German Federal Gazette: BAnz AT 23.07.2013 B4, chapter V
2nd notification, UBA announcement dated 03 July 2013:

2 Notification as regards Federal Environment Agency (UBA) notices of 23 February 2012 (BAnz. p. 920, chapter I number 4.5) and of 12 February 2013 (BAnz AT 05.03.2013 B10, chapter V 28th notification)

The ENDA-5000 measuring system with its CMA-5800 analyser module monitoring NO_x, SO₂, CO, CO₂ and O₂ manufactured by Horiba GmbH may also be sold with a variety of measuring channel combinations. The following table lists the AMS designation which indicates the relevant scope of measured components:

Model: ENDA-5000 with analyser module	Component 1	Component 2	Component 3	Component 4	Component 5
CFA-5140	CO ₂	-	-	-	-
CFA-5150	CO	-	-	-	-
CMA-5160	O ₂	-	-	-	-
CMA-5220	NO _x	O ₂	-	-	-
CMA-5230	SO ₂	O ₂	-	-	-
CMA-5240	CO ₂	O ₂	-	-	-
CMA-5250	CO	O ₂	-	-	-
CFA-5370	CO	CO ₂	-	-	-
CMA-5400	NO _x	SO ₂	O ₂	-	-
CMA-5410	NO _x	CO ₂	O ₂	-	-
CMA-5420	NO _x	CO	O ₂	-	-
CMA-5440	SO ₂	CO ₂	O ₂	-	-
CMA-5450	SO ₂	CO	O ₂	-	-
CMA-5470	CO	CO ₂	O ₂	-	-
CMA-5600	NO _x	SO ₂	CO ₂	O ₂	-
CMA-5610	NO _x	SO ₂	CO	O ₂	-
CMA-5620	NO _x	CO	CO ₂	O ₂	-
CMA-5630	SO ₂	CO	CO ₂	O ₂	-
CMA-5800	NO _x	SO ₂	CO	CO ₂	O ₂

Statement issued by TÜV Rheinland Energie und Umwelt GmbH
dated 26 March 2013

Publication in the German Federal Gazette: BAnz AT 05.08.2014 B11, chapter V
8th notification, UBA announcement dated 17 July 2014:

8 Notification as regards Federal Environment Agency (UBA) notices of 23 February 2012 (BAnz. p. 920, chapter I number 4.5) and of 03 July 2013 (BAnz AT 23.07.2013 B4, chapter V, 2nd notification)

Due to the name change which has been made the new system designations for the ENDA-5000 measuring system manufactured by Horiba GmbH are:

Previous designation Model: ENDA-5000 with analyser module	New designation Model: ENDA-5000 with analyser module	Component 1	Component 2	Component 3	Component 4	Component 5
CFA-5140	CFA-5140 E	CO ₂	-	-	-	-
CFA-5150	CFA-5150 E	CO	-	-	-	-
CMA-5160	CMA-5160 E	O ₂	-	-	-	-
CMA-5220	CMA-5220 E	NO _x	O ₂	-	-	-
CMA-5230	CMA-5230 E	SO ₂	O ₂	-	-	-
CMA-5240	CMA-5240 E	CO ₂	O ₂	-	-	-
CMA-5250	CMA-5250 E	CO	O ₂	-	-	-
CFA-5370	CFA-5370 E	CO	CO ₂	-	-	-
CMA-5400	CMA-5400 E	NO _x	SO ₂	O ₂	-	-
CMA-5410	CMA-5410 E	NO _x	CO ₂	O ₂	-	-
CMA-5420	CMA-5420 E	NO _x	CO	O ₂	-	-
CMA-5440	CMA-5440 E	SO ₂	CO ₂	O ₂	-	-
CMA-5450	CMA-5450 E	SO ₂	CO	O ₂	-	-
CMA-5470	CMA-5470 E	CO	CO ₂	O ₂	-	-
CMA-5600	CMA-5600 E	NO _x	SO ₂	CO ₂	O ₂	-
CMA-5610	CMA-5610 E	NO _x	SO ₂	CO	O ₂	-
CMA-5620	CMA-5620 E	NO _x	CO	CO ₂	O ₂	-
CMA-5630	CMA-5630 E	SO ₂	CO	CO ₂	O ₂	-
CMA-5800	CMA-5800 E	NO _x	SO ₂	CO	CO ₂	O ₂

The current software version for the ENDA-5000 measuring system manufactured by Horiba GmbH is: P1000877001K

As far as the analysis modules without an SO₂ measurement channel listed above are concerned there is no need for the injection of phosphoric acid.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 1 April 2014

Publication in the German Federal Gazette: BAnz AT 01.08.2016 B11, chapter V
7th notification, UBA announcement dated 14 July 2016:

**7 Notification as regards Federal Environment Agency (UBA) notices
of 23 February 2012 (BAnz. p. 920, chapter I number 4.5) and
of 17 July 2014 (BAnz AT 05.08.2014 B11, chapter V 8th notification)**

The ENDA 5000 measuring system with the CMA-5800 analyser module monitoring NO_x, SO₂, CO, CO₂ and O₂ manufactured by HORIBA GmbH is equipped with a new display which, in design and functionally, largely corresponds to its predecessor. In addition, the power supply ZWS-BAF may also be used.

The current software version of the measuring system is:
P1000877001L

Statement issued by TÜV Rheinland Energie und Umwelt GmbH ‘
dated 29 February 2016

Publication in the German Federal Gazette: BAnz AT 03.05.2021 B9, chapter III
41st notification, UBA announcement dated 31 March 2021:

**41 Notification as regards Federal Environment Agency (UBA) notices
of 23 February 2012 (BAnz. p. 920, chapter I number 4.5) and
of 14 July 2016 (BAnz AT 01.08.2016 B11, chapter V 7th notification)**

The ENDA-5000 measuring system with the CMA-5800 E analyser module for NO_x, SO₂, CO, CO₂ and O₂ manufactured by HORIBA GmbH can also be used with gas sampling probes of type GAS 222.17 from Bühler Technologies GmbH or of the identical type SP-46 from HORIBA GmbH.

Statement issued by TÜV Rheinland Energy GmbH dated 27 August 2020

Certified product

This certification applies to automated measurement systems conforming to the following description:

The measuring system is a multicomponent gas analyser for the measurement of emissions. The analyser of the type series ENDA-5000 is a measuring system to continuously observe the concentration of NO_x, SO₂, CO, CO₂ and O₂ at stationary emission sources. It measures simultaneously the five above listed gas components. The system measures the concentration of the components NO_x, SO₂, CO, CO₂ and O₂ in dry conditions because the moisture from the measuring gas is removed with help of sample gas coolers. For the measuring channels NO_x, SO₂, CO and CO₂ the non-dispersive infrared ray absorptiometry with cross modulation system (NDIR) is used.

For the determination of the oxygen concentration a magneto-pneumatic system (MPA) is applied, which is free from cylinder gas as a carrier gas.

For the minimisation of the SO₂ losses in the sample conditioning system a 10 percent phosphoric acid is added upstream of the sample gas cooler into the hot sample gas.

General remarks

This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the requirements of the EN 15267. The manufacturer is required to maintain an approved quality management system controlling the manufacturing process for the certified product. Both the product and the quality management systems shall be subject to regular surveillance.

If a product of the current production does not conform to the certified product, TÜV Rheinland Energy GmbH must be notified at the address given on page 1.

A certification mark with an ID-Number that is specific to the certified product is presented on page 1 of this certificate.

This document as well as the certification mark remains property of TÜV Rheinland Energy GmbH. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must no longer be used.

The relevant version of this certificate and its expiration date are also accessible on the internet at qal1.de.

Document history

Certification of the ENDA-5000 measuring system is based on the documents listed below and the regular, continuous surveillance of the manufacturer's quality management system:

Initial certification according to EN 15267

Certificate no. 0000035010_00: 16 March 2012
Expiry date of the certificate: 01 March 2017
Test report: 936/21212266/A of 18 October 2011
TÜV Rheinland Energie und Umwelt GmbH
Publication: BAnz. 02 March 2012, no. 36, p. 920, chapter I number 4.5
UBA announcement dated 23 February 2012

Notifications in accordance with EN 15267

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 20 March 2012
Publication: BAnz AT 20.07.2012 B11, chapter IV notification 4
UBA announcement dated 06 July 2012
(Extension for sampling probes)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 11 October 2012
Publication: BAnz AT 05.03.2013 B10, chapter V notification 28
UBA announcement dated 12 February 2013
(Design changes)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 26 March 2013
Publication: BAnz AT 23.07.2013 B4, chapter V notification 2
UBA announcement dated 03 July 2013
(Measuring system variants)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 1 April 2014
Publication: BAnz AT 05.08.2014 B11, chapter V notification 8
UBA announcement dated 17 July 2014
(AMS designation changed)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 28 February 2016
Publication: BAnz AT 01.08.2016 B11, chapter V notification 7
UBA announcement dated 14 July 2016
(Design changes)

Renewal of the certificate

Certificate no. 0000035010_01: 28 February 2017
Expiry date of the certificate: 01 March 2022

Notifications in accordance with EN 15267

Statement issued by TÜV Rheinland Energy GmbH dated 27 August 2020
Publication: BAnz AT 03.05.2021, B9, chapter III notification 41
UBA announcement dated 31 March 2021
(Design changes)

Renewal of the certificate

Certificate no. 0000035010_02: 16 February 2022
Expiry date of the certificate: 01 March 2027

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

Manufacturer	Horiba GmbH
Name of measuring system	ENDA-5000
Serial number of the candidates	0900500 / 09105800
Measuring principle	NDIR

Test report

Test laboratory	936/21212266/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	NO _x as NO 0 - 100 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	1.30 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at reference point	3.00 mg/m ³
Sum of negative CS at reference point	0.00 mg/m ³
Maximum sum of cross sensitivities	3.00 mg/m ³
Uncertainty of cross sensitivity	1.732 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u _D 0.372 mg/m ³	0.138 (mg/m ³) ²
Lack of fit	u _{lof} 0.173 mg/m ³	0.030 (mg/m ³) ²
Zero drift from field test	u _{d,z} -0.543 mg/m ³	0.295 (mg/m ³) ²
Span drift from field test	u _{d,s} -1.547 mg/m ³	2.393 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.954 mg/m ³	0.910 (mg/m ³) ²
Influence of supply voltage	u _v 0.580 mg/m ³	0.336 (mg/m ³) ²
Cross sensitivity (interference)	u _i 1.732 mg/m ³	3.000 (mg/m ³) ²
Influence of sample gas flow	u _o 0.204 mg/m ³	0.042 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.808 mg/m ³	0.653 (mg/m ³) ²
Converter efficiency for AMS measuring NO _x	u _{ce} 1.900 mg/m ³	3.610 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 3.38 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 6.62 \text{ mg/m}^3$$

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the ELV 131 mg/m ³	5.1
U in % of the ELV 131 mg/m ³	20.0
U in % of the ELV 131 mg/m ³	15.0

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

Manufacturer	Horiba GmbH
Name of measuring system	ENDA-5000
Serial number of the candidates	0900500 / 09105800
Measuring principle	NDIR

Test report

Test laboratory	936/21212266/A TÜV Rheinland
Date of report	2011-10-18

Measured component

	SO ₂
Certification range	0 - 75 mg/m ³

Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	2.85 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at reference point	2.80 mg/m ³
Sum of negative CS at reference point	-0.90 mg/m ³
Maximum sum of cross sensitivities	2.85 mg/m ³
Uncertainty of cross sensitivity	1.645 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Standard deviation from paired measurements under field conditions *	u _D 0.416 mg/m ³	0.173 (mg/m ³) ²
Lack of fit	u _{lof} 0.346 mg/m ³	0.120 (mg/m ³) ²
Zero drift from field test	u _{d,z} -0.624 mg/m ³	0.389 (mg/m ³) ²
Span drift from field test	u _{d,s} 0.784 mg/m ³	0.615 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.755 mg/m ³	0.570 (mg/m ³) ²
Influence of supply voltage	u _v 0.367 mg/m ³	0.135 (mg/m ³) ²
Cross sensitivity (interference)	u _i 1.645 mg/m ³	2.708 (mg/m ³) ²
Influence of sample gas flow	u _p 0.045 mg/m ³	0.002 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.606 mg/m ³	0.368 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	2.25 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	4.42 mg/m ³

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the ELV 50 mg/m ³	8.8
U in % of the ELV 50 mg/m ³	20.0
U in % of the ELV 50 mg/m ³	15.0

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

Manufacturer	Horiba GmbH
Name of measuring system	ENDA-5000
Serial number of the candidates	0900500 / 09105800
Measuring principle	NDIR

Test report

Test laboratory	936/21212266/A TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	CO 0 - 50 mg/m ³
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	1.23 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at reference point	1.30 mg/m ³
Sum of negative CS at reference point	0.00 mg/m ³
Maximum sum of cross sensitivities	1.30 mg/m ³
Uncertainty of cross sensitivity	0.751 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

	u	u ²
Repeatability standard deviation at set point *	u _r 0.650 mg/m ³	0.423 (mg/m ³) ²
Lack of fit	u _{lof} -0.173 mg/m ³	0.030 (mg/m ³) ²
Zero drift from field test	u _{d,z} -0.127 mg/m ³	0.016 (mg/m ³) ²
Span drift from field test	u _{d,s} 0.650 mg/m ³	0.423 (mg/m ³) ²
Influence of ambient temperature at span	u _t 0.643 mg/m ³	0.413 (mg/m ³) ²
Influence of supply voltage	u _v 0.163 mg/m ³	0.027 (mg/m ³) ²
Cross sensitivity (interference)	u _i 0.751 mg/m ³	0.563 (mg/m ³) ²
Influence of sample gas flow	u _p -0.018 mg/m ³	0.000 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.404 mg/m ³	0.163 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.43 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.81 mg/m ³

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC

Requirement of EN 15267-3

U in % of the ELV 50 mg/m ³	5.6
U in % of the ELV 50 mg/m ³	10.0
U in % of the ELV 50 mg/m ³	7.5

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

Manufacturer	Horiba GmbH
Name of measuring system	ENDA-5000
Serial number of the candidates	0900500 / 09105800
Measuring principle	NDIR

Test report

Test laboratory	TÜV Rheinland	✓
Date of report	2011-10-18	✓

Measured component

Certification range	CO ₂	0 - 20 Vol.-%
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of positive CS at reference point	0.00	Vol.-%
Sum of negative CS at reference point	-0.19	Vol.-%
Maximum sum of cross sensitivities	-0.19	Vol.-%
Uncertainty of cross sensitivity	-0.110	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

	u		u ²	
Standard deviation from paired measurements under field conditions *	u _D 0.094	Vol.-%	0.009	(Vol.-%) ²
Lack of fit	u _{lof} -0.115	Vol.-%	0.013	(Vol.-%) ²
Zero drift from field test	u _{d,z} -0.072	Vol.-%	0.005	(Vol.-%) ²
Span drift from field test	u _{d,s} 0.311	Vol.-%	0.097	(Vol.-%) ²
Influence of ambient temperature at span	u _t 0.100	Vol.-%	0.010	(Vol.-%) ²
Influence of supply voltage	u _v 0.067	Vol.-%	0.004	(Vol.-%) ²
Cross sensitivity (interference)	u _i -0.110	Vol.-%	0.012	(Vol.-%) ²
Influence of sample gas flow	u _b -0.005	Vol.-%	0.000	(Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.162	Vol.-%	0.026	(Vol.-%) ²

* The larger value is used :
"Repeatability standard deviation at span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.42	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.82	Vol.-%

Relative total expanded uncertainty	U in % of the range 20 Vol.-%	4.1
Requirement of 2000/76/EC and 2001/80/EC	U in % of the range 20 Vol.-%	10.0
Requirement of EN 15267-3	U in % of the range 20 Vol.-%	7.5

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
The chosen value is recommended by the certification body.

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

Manufacturer	Horiba GmbH
Name of measuring system	ENDA-5000
Serial number of the candidates	0900500 / 09105800
Measuring principle	Paramagnetismus

Test report

Test laboratory	TÜV Rheinland
Date of report	2011-10-18

Measured component

Certification range	O ₂	0 - 25 Vol.-%
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Evaluation of the cross sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00	Vol.-%
Sum of negative CS at zero point	0.00	Vol.-%
Sum of positive CS at reference point	0.00	Vol.-%
Sum of negative CS at reference point	-0.19	Vol.-%
Maximum sum of cross sensitivities	-0.19	Vol.-%
Uncertainty of cross sensitivity	-0.110	Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

	u		u ²	
Standard deviation from paired measurements under field conditions *	u _D 0.191	Vol.-%	0.036	(Vol.-%) ²
Lack of fit	u _{lof} 0.040	Vol.-%	0.002	(Vol.-%) ²
Zero drift from field test	u _{d,z} -0.173	Vol.-%	0.030	(Vol.-%) ²
Span drift from field test	u _{d,s} 0.162	Vol.-%	0.026	(Vol.-%) ²
Influence of ambient temperature at span	u _t 0.056	Vol.-%	0.003	(Vol.-%) ²
Influence of supply voltage	u _v 0.027	Vol.-%	0.001	(Vol.-%) ²
Cross sensitivity (interference)	u _i -0.110	Vol.-%	0.012	(Vol.-%) ²
Influence of sample gas flow	u _p 0.039	Vol.-%	0.002	(Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u _{rm} 0.202	Vol.-%	0.041	(Vol.-%) ²

* The larger value is used :
"Repeatability standard deviation at span" or
"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.39	Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.77	Vol.-%

Relative total expanded uncertainty

Requirement of 2000/76/EC and 2001/80/EC	U in % of the range 25 Vol.-%	3.1
Requirement of EN 15267-3	U in % of the range 25 Vol.-%	10.0 **
	U in % of the range 25 Vol.-%	7.5

** For this component no requirements in the EC-directives 2001/80/EG und 2000/76/EG are given.
A value of 10.0 % was used for this.